PATENT SPECIFICATION 1,191,520
DRAWINGS ATTACHED.

1,191,520

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COMPLETE SPECIFICATION.

Improvements in Devices Having a Variable Width Slit or Aperture.

We, COMPAGNIE FRANCAISE THOMSON HOUSTON-HOTCHKISS BRANDT, a French Body Corporate of 173, Boulevard Haussmann, Paris 8e, France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to improvements in devices having a variable width slit or aperture and more particularly to a high precision device for varying the width of an adjustable aperture intended for the passage of a beam of particles.

Examples are numerous in physics, where it is necessary to stop down a beam of particles along a predetermined section, with high precision, of the order of one micron, the adjustment of the width of the slit or aperture being required to be variable over a range from complete obturation to a width of passage reaching 1500 microns.

This is the case in particular in mass spectrography where it is desired to obtain, inside an enclosure under high vacuum and which may be baked, a beam of ionised atoms, the useful width of which may be adjusted. This is generally obtained with the aid of slits having very precise widths which may be adjusted for example from 0 to 150 microns for the source of ions and from 0 to 1500 microns for the collector.

Devices having a variable aperture are known which are produced with the aid of two blades, as least one of which is movable and moves in the plane of the other blade, the width of the slit being determined by the spacing of the sections opposite. However, these devices do not permit a total obturation nor the desired precision. Moreover, they are generally of a high cost.

The present invention consists in a device enabling the width of an aperture to be varied with precision, said device comprising a diaphragm with an aperture therein which can be obturated by two blades, one of which is fixed and the other of which is supported for rotation by a pivot, aperture obturation being effected by covering the edge of the fixed blade by the edge of the movable blade.

Preferably the pivot is supported at least at one of its ends by a resilient member and is rotatably mounted on bearings.

Moreover, the edge of the movable blade and the edge of the fixed blade conveniently remain parallel in all positions.

Also, in a preferred embodiment, the aperture is circular and the edge of the fixed blade projects onto an axis passing through a diameter of said circle.

More particularly, both the blades have their edges trued so that their thickness is close to 100 microns.

Also the device is made of a material, for example stainless steel, which may support temperatures of the order of 250°C.

The invention will now be further described by way of example with reference to the accompanying drawings in which:—

Figure 1, is a simplified view in elevation of one embodiment of a device having a variable slit according to the present invention, and

Figure 2, shows a sectional view on a larger scale, of a part of the device, taken along the line X_1—X_2 of Figure 1.

Referring to the Figures, a device having a variable slit comprises a diaphragm in the form of a disc 1 pierced at its centre with a calibrated aperture 2, the shape of which is preferably circular and the diameter of which is chosen to be of the order of 1 centimetre. The following members are all fixed to the disc 1 on the same face thereof:—

Firstly, there is shown a fixed blade 3, such as a razor blade for example, having a bevelled thickness of 100 microns and covering exactly one half of the aperture 2, the bevelled edge of this blade projecting exactly onto an axis "*a b*" which passes through a diameter of the aperture 2. The blade 3 has one bevelled edge trued to 1 micron and is fixed to the disc 1 by means of screws 4 and 5 and an intermediate member 14.

Secondly, there is shown a pivot constituted by a rotatable cylindrical rod 6 which carries a blade 7 preferably identical to the blade 3. The blade 7 is carried by a member 15 which is fixed parallel to the generatrices of the rod 6. The bevelled edges of the two blades are adjusted with the aid of a microscope, so as to be strictly parallel and in an "open" position they constitute the edges of an effective aperture embraced by the aperture 2. The assembly is such that when the aperture 2 is obturated, a section of the movable blade 7 covers the fixed blade 3 by approximately five microns for example.

In order to open the aperture, the pivot 6 is rotated, this causing the rotation of the movable blade 7, the bevelled edge of which thus describes a cylindrical surface 16 centered on the axis "*c d*" of the said pivot, the bevelled edge of the movable blade 7 remaining constantly parallel to the bevelled edge of the fixed blade 3. In the case of mass spectrography, the movement of rotation is controlled externally of a vacuum-enclosure containing the device, by means of a rod actuated by rectilinear movement. Such a rod passes through a wall of the enclosure in a sealed manner and contacts a lever fixed to the head of the pivot, perpendicularly thereto. The control rod is coupled to a comparator which records its displacements and permits measurements calculated in microns. This drive device does not form part of the invention and has not been shown. The cylindrical rod 6 forming the pivot is provided at its ends with two conical and reversed bearing surfaces 8, 8*a*, permitting them to be inserted between two bearings 9, 10 positioned on either side of the aperture and having the same axis "c d" as the pivot. These conical bearings 9, 10 reduce friction to a minimum, which may be particularly advantageous in an assembly which must be baked to obtain a good vacuum in the enclosure. The upper bearing 9 is fixed to the disc 1 and its position is defined hereinabove. The bearing 9 is traversed by the end 11 of the pivot and it is at this region that there is effected the rotational control of the pivot, as mentioned above. The lower bearing 10 is also fixed to the disc 1. Its position is also defined hereinabove and it comprises moreover a bore in which there slides a socket 12. This socket is held at its base end by a spring 13 and at its other end serves as a centre-casting for the pivot rod 6.

Figure 2 is a view, on a larger scale and in horizontal section along line X_1X_2, of the central part of the device of Figure 1, the same reference numerals relating to the same parts. This Figure shows more clearly various features referred to above. Thus there is shown the fixed blade 3 carried by the said member 14 which is integral with the disc 1. The bevelled edge of the blade 3, 100 microns thick, projects exactly over the axis "*a b*". The movable blade 7 is fixed to the member 15 which is integral with the pivot 6 and fixed parallel to the generatrices of the latter. The thickness of the blade 7 is, as previously stated, advantageously the same as that of the blade 3 and in the position of obturation shown, the end of its bevel "*e m*" covers the fixed blade by a few microns, 5 for example. When the pivot 6 rotates, the edge "*e m*" of the movable blade 7 moves over the cylindrical surface 16 centered on the axis "*c d*" of the pivot. The section of the blade 7 thus remains parallel to the section of the fixed blade 3. In order to allow clearance for the movable blade 7, the surface S_1 of the member 15 is situated at a distance of a few tenths of a millimetre, 5 for example, away from the surface of the disc 1 (i = 0.5 mm). In order to obtain an effective aperture width of 150 microns, the necessary rotation of the pivot 6 is smaller than 2° and, in order to obtain an effective aperture width of 1500 microns, it is smaller than 15°. In this latter example, the movable blade 7 and its support occupy the position shown in dotted lines.

The device described, operating in vacuo, must be capable of being baked at temperatures of the order of 250°C without being damaged and for this reason, is preferably made of stainless steel. The device has the advantage of presenting a minimum of friction between the movable members, and the movement of rotation is to a certain extent resilient due to the constant pressure given by the spring 13. The assembly may be baked at 250°C in order to obtain, in the enclosure in which it is contained, a pressure of 10^{-9} Torr. The pivot 6 may expand linearly, its expansion being accommodated by the movable socket 12. Moreover, the cost price of the device is of the order of one tenth of that of existing devices, whilst still ensuring an accuracy of alignment and of aperture width to about 1 micron. Because of such accuracy its use is therefore suitable in most ionic optical devices.

WHAT WE CLAIM IS:—

1. A device enabling the width of an

aperture to be varied with precision, said devices comprising a diaphragm with an aperture therein which can be obturated by two blades, one of which is fixed and the other of which is supported for rotation by a pivot, aperture obturation being effected by covering the edge of the fixed blade by the edge of the movable blade.

2. Device according to claim 1, wherein the pivot is supported at at least one of its ends by a resilient member and is rotatably mounted on bearings.

3. Device according to claim 1 or 2, wherein the edge of the movable blade and the edge of the fixed blade remain parallel in all positions.

4. Device according to any preceding claim, wherein the aperture is circular and the edge of the fixed blade projects onto an axis passing through a diameter of said circle.

5. Device according to any preceding claim, wherein the edges of the blades are trued, their thickness being about 100 microns.

6. Device according to any preceding claim, when made of stainless steel.

7. A device enabling the width of an aperture to be varied with precision, substantially as hereinbefore described with reference to the accompanying drawings.

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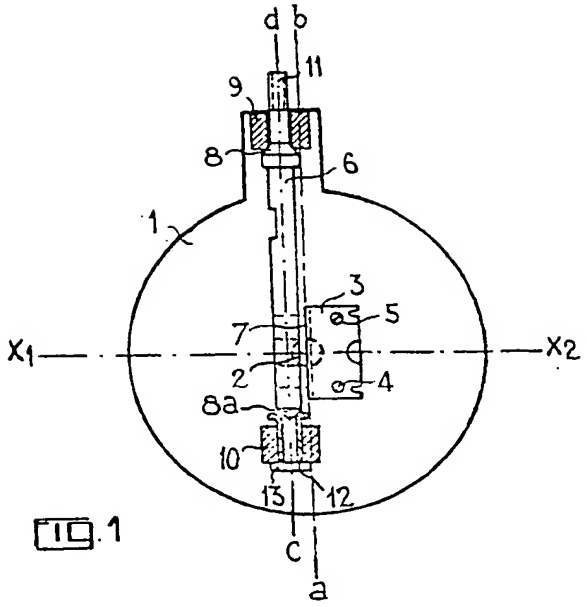
d
b
11
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8
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X1
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FIG. 1

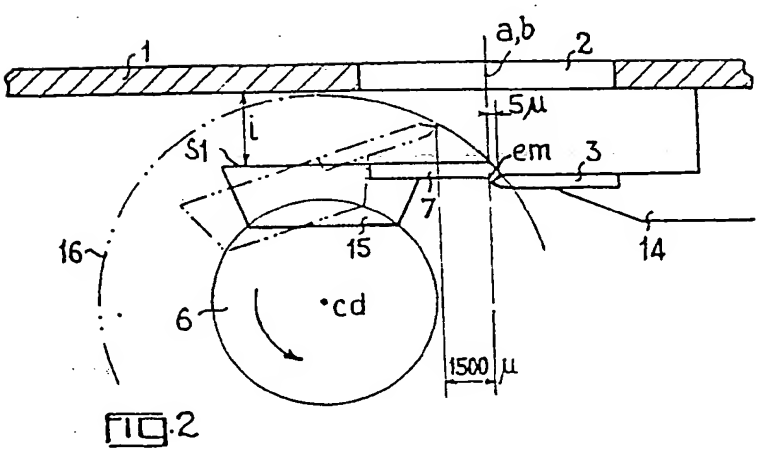
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FIG. 2